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SELECTED TRANSLATIONS ON EAST EUROPEAN HEAVY INDUSTRY

No. 6

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No. 6

This is a serial publication containing selected translations on the manufacturing and chemical industries in Eastern Europe.

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EAST GERMANY

TRANSISTORIZED MINIATURE RADIO TRANSMITTERS: SHORT DESCRIPTION OF EQUIPMENT USED

[Following is the translation of an article by Hossner in Radio und Fernsehen (Radio and Television), Vol 24, Ninth year, Berlin, December 1960, pages 766-767.]

Up to this point the development laboratories of the VEB Stern-Radio Sonneberg were concerned with radio equipment exclusively, i.e., equipment manufactured in large numbers and with special attention given to low cost. If commercial equipment is now to be developed there, this will have a certain effect on the product to be made. This will consist of mainly the following: the modules required for the construction of modern equipment must be made up of parts presently available in the production of radio equipment. This will save tooling costs and development time. As an example three modules of a miniature transmitter are shown (Fig. 15). Shielding covers have been removed for better viewing. Printed circuit boards form the base supports of these three modules.

Present development plans will be given, and attention should be given to the fact that simultaneously with the development construction of prototype equipment is being accomplished for testing at VEB Kombinat Schwarze Pumpe, the results of which are being applied in the construction of the following equipment. This method of development shortens the overall development time and provides the basic materials industry at the same time with the equipment needed.

1. Transistorized Miniature Transmitter

Following specifications the range of these transmitters should be only a few hundred meters; however, sufficient power should be available to be able to communicate from within the plant to be built with the outside world. The transmitter was built according to the block diagram shown in Fig. 17.

The Funkwerk Koelleda hearing aid was used as a microphone, whose output voltage was amplified by means of the transistor OC811 in the modulation amplifier. This amplified voltage drives the base of the oscillator transistor OC 169. The transmitter works on frequency modulation, attaining a frequency deviation of 100 kc with a sufficiently small distortion factor. The question of frequency stability was of major concern during the development phase.

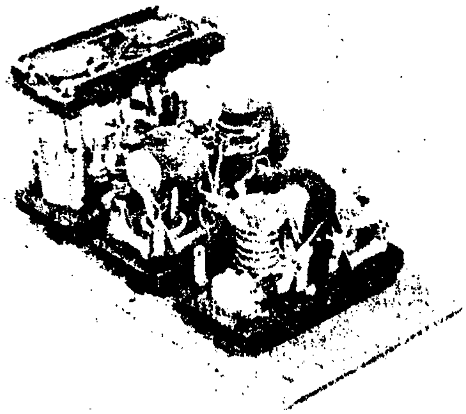

Bild 15: Die drei Baustufen des Senders: vorn die Endstufe, in der Mitte die Oszillatorstufe und hinten (größte Stufe) die Modulationsstufe

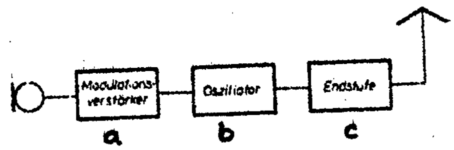

Bild 17: Blockschaltung des Senders

Fig. 15. The three construction stages of the transmitter: front, output stage, center oscillator stage, background (largest) modulation stage

Fig. 17. Transmitter block diagram
Legend: a-modulation amplifier
b-Oscillator
c-Output stage

Use of crystal control was not made, since selection of this particular circuit precludes frequency drift due to voltage change in the battery. Temperature compensation is provided for. The oscillator works on the fundamental frequency with an operating frequency between 73 and 83 mc, as desired. Tuning of the oscillator stage and output stage is accomplished by means of HF iron core slugs. The output stage works simultaneously with the transistor OC 169 base. Originally a quarter wave-length antenna was used, but it appeared that the antenna could be shortened considerably for this purpose, and this inconvenience to the operator could be avoided. A Kleinakkubatterie, 12 volts, made by VEB Elektrochemische Fabrik, Sonneberg, Thueringen, constitutes the power source, whose cells are used in the well known flashlights. The transmitter requires approximately 12 ma. The first model of the transmitter ran for two months without changing batteries. All transistors used stood up well under the heavy current and voltage loads.

Further developments are aimed at greater frequency stability of the transmitter as well as a different application with greatly increased output and frequency range over the entire frequency spectrum.

2. AC power plug-in receivers.

The counterpart of the transistorized transmitter is a special AC plug-in type receiver. The question naturally arises, why not a transistorized receiver. The decision for the AC receiver was based on two factors:

a) In view of the present availability of USW transistors in the DDR (GDR), transistors should be used only where this

is unavoidable, such as in portable receivers. Since the receiving stations are on cranes with AC power available, the use of this type receivers is not a backward step.

b) AC receivers can be made within our plant with only slight modifications in the buildup of existing equipment.

To establish proper communications each crane is provided with two receivers with common antenna and one transistorized transmitter. Conversation takes place between the two crane operators and one or two foremen stationed on the construction site. The receivers must satisfy the following specifications:

a) Maximum sensitivity and static limitation. Sensitivity values achieved in the receivers are below one microvolt, with static limitation at one microvolt.
b) Maximum noise suppression.
c) Constant temperature (temperature stability).
d) Minimum passband shift due to imput voltage variation.
e) Continuous tuning from 70 to 83 mc.
f) One watt output.
g) Full suppression of noise in the absence of carrier.

These specifications have been met in their greater part with the equipment now undergoing tests. Further demands on the equipment based on test results were:

h) Linear scale should be extended over the full width of the equipment
i) Automatic volume control as a function of extraneous noise.

In view of the closeness of the construction site to the power plant West, sometimes the noise level within the control cabin of the cranes gets so high that communication is possible only by turning the volume up to maximum. In order not to distract the crane operator, the volume is automatically turned up by means of a driving microphone outside the cabin, which is made noise sensitive.

j) Automatic fine tuning at frequency change for the crane operator gear.

These needed improvements will be incorporated in the future equipment.

3. Portable transistorized receivers

This receiver is designed to reach persons or groups of people on the construction site by means of the existing 10 watt station. The circuitry of this receiver offers no special problems. The following transistors were used:

OC 171, USW preamplifier and mixer
OC 169, IF amplifier
OC 812, Impedance stage and LF preamplifier
OC 811, driver
OC 816, Output stage

Input sensitivity is approximately three microvolts, output 100 mw maximum, quieting 8 ma, maximum current use 30 ma. The antenna is a quarter wavelength type with fiberglas shield and the loudspeaker a "Sternchen" type.

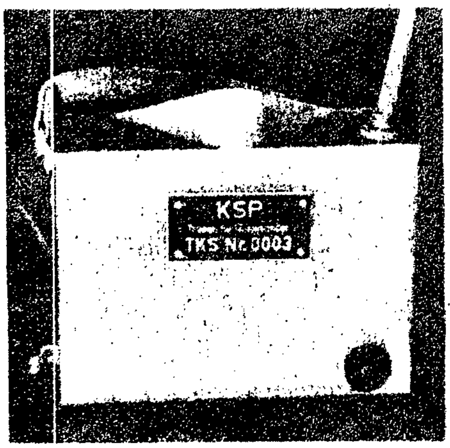

Bild 13: Außenansicht des volltransistorisierten Kleinsenders

Fig. 13. Exterior view of fully transistorized miniature transmitter

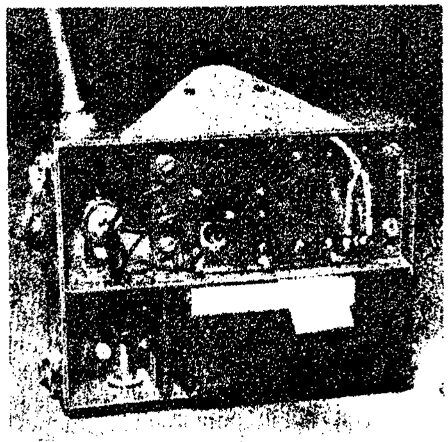

Bild 14: Blick in den geöffneten Kleinsender

Fig. 14. Interior of open miniature transmitter

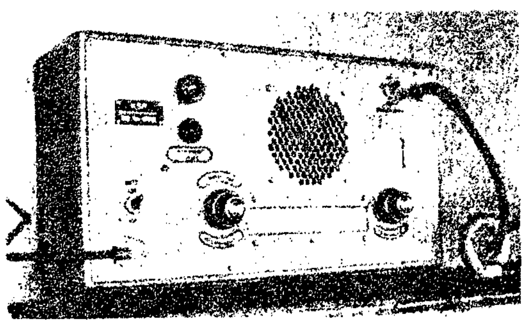

Bild 16: Außenansicht des Netzempfängers

Fig. 16. Exterior view of AC receiver

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EAST GERMANY

SOCIALIST COMMUNITY WORK IN AIRPLANE CONSTRUCTION

/Following is the translation of an article by Karl-Heinz Koehler in Deutsche Flugtechnik (German Airplane Engineering), Vol IV (1960), No 12, Berlin, pages 353-356./

Development of Socialist Community Work

In the evaluation of the resolutions of the Fifth Party Congress and subsequent meetings, especially the Fifth session of the Central Committee of the Socialist Unity Party of Germany, the first brigades of the socialist labor, working, and research communities were formed in the VEB Industrial Works, Karl-Marx-Stadt, on the initiative of the party, social mass organizations, and factory management.

The most experienced comrades, production workers, engineers, and management cadres were delegated to these brigades and work communities. The examples accomplished and the success achieved were evaluated and popularized through the plant's public address system and newspaper. A characteristic of the beginning of this movement was that in the VEB Industrial Works, Karl Marx-Stadt, nobody worked for himself only; under the guidance of the central party leadership, the management of the plant's trade-union, and social mass organizations, economic officials approached the solution of the tasks in a coordinated way. As an instrument to coordinate all tasks and in the interest of unfolding the socialist community work, a so-called "Operations Staff" was created, in which the representatives of the party, social mass organizations, and the leading economic officials together considered tasks which were of decisive importance and determined the ways for their solution. The successes of the unfolding of socialist community work on a large scale are reflected most obviously in the fact that the plant fulfilled its plan in the plan year 1959.

The plant could fulfill the plan for gross production in the first half of 1960 by 110.2 per cent. Besides, those brigades which were competing for the honorary title of "Brigade of Socialist Labor" achieved a saving of 580,000 DM.

Near the end of August, 1960, there were 160 brigades in the VEB Industrial Works Karl Marx-Stadt that were competing for the honorary title of "Brigade of Socialist Labor". They comprised about 85 per cent of all manual workers. In addition, there were 40 socialist work and research communities with 407 members in the plant at this time. In this way, approximately 65 per cent of the working force in the plant was in socialist community work on the solution of the tasks assigned to the plant.

Through this unfolding of socialist community work on a large scale,

the manual workers, who comprise 85 per cent of the workers in the plant, could be won over to taking part in the socialist competition. In order to uncover the reasons for absenteeism and non-utilization of time, over 50 per cent of all manual workers in basic sectors were using the method of "The Hero of Labor," Erich Seifert.

In order to raise the qualifications of the working people in the VEB Industrial Works Karl Marx-Stadt, a factory school was started last year. At this factory school, over 800 working people were improving their qualifications in 35 courses and lecture series. In addition, 155 students were continuing their university and vocational studies in correspondence and evening courses. Through the development of socialist community work and intensive educational work, the measures aimed at improving the existing qualifications extended to 45 per cent of the working force.

Development of Socialist Brigades

In addition to the evaluation of quantitative development of the socialist community work that undoubtedly reached a high level in the VEB Industrial Works Karl Marx-Stadt, the qualitative development of this movement must mentioned. Already, before the formation of the brigades that compete for the honorary title of "Brigades of Socialist Labor," members worked together in work brigades that came into being mostly because of the particular structure of the plant or nature of the tasks at a given moment. These collectives were also taking part mostly in the socialist competition for the solution of production and quality problems. Although these collectives form, to a large extent, the basis of today's socialist brigades, present activities have a higher content.

Using clear programs, the brigades have set themselves a task not only to work socialistically, but also to live and learn socialistically, in order to fulfill the conditions attached to the granting of the state honorary title of "Brigade of Socialist Labor". The process of transformation of the collective into a brigade of socialist labor will be shown below using a concrete example from the VEB Industrial Works Karl Marx-Stadt.

Development of Socialist Work and Research Communities

Socialist work and research communities set themselves the goal of solving certain tasks of decisive importance in the shortest possible time, especially to achieve a world standard for certain products. Scientists, designers, workers and technologists work in these fields. Through this composite of socialist work and research communities, the sources of shortcomings in the development, construction, sample and mass production etc. are being considerably reduced, if not eliminated, and a faster development of production forces of the socialist society is achieved.

However, this is only one side of socialist community work. Through the socialist community relations, a reorganization of common life of the people in the socialist society is being brought about as a result of

political and ideological struggles of the working class and its party.

Workers and members of technical intelligentsia learn to know and to appreciate each other in socialist community work.

This is one reason why the formation of socialist work communities must be combined with ideological discussions.

In the investigation of the past development of socialist community work in the VEB Industrial Works Karl Marx-Stadt, it was possible to establish that the representatives of technical intelligentsia are working together. It is a different matter in socialist work and research communities in which, often times no manual workers or too few of them are cooperating. For this reason, the composition of the socialist work and research communities has to be changed to include more production workers.

Let us turn now to some instances from which the development, tasks, and successes of the socialist community work will be seen.

The growing production program of the VEB Industrial Works Karl Marx-Stadt called for higher standards in the facilities for handling of the heat produced during surface hardening. Customary processing (powder carburization, salt bath carburization, etc.) with rising piece work rates is not adequate for attaining a continuous and efficient surface hardening. In this kind of processing, the carbon is transformed from a solid into a gas in order to obtain carbonized elements.

In the highly industrialized capitalist countries, for instance, the U.S.A. and West Germany, a process has been developed which eliminates the obvious detour via solid carbon and at the same time uses the gas as a carbon carrier. With such facilities, it is possible to achieve a considerable increase in labor productivity.

As indicated above, the rising level of production program makes the introduction of such facilities necessary in order to achieve efficient production with this processing technique.

Under the guidance of the manager of the finishing department, engineer V. Gittel, a socialist work community set itself the task on 17 November 1959 of developing a machine for gas carburization which would consist exclusively of parts made in the GDR.

Another task was a scientific exploration of the possibility of using the available city gas as carrier gas for gas carburization. In connection with the Technological School of Machine Construction Karl Marx-Stadt, a thesis dealing with the solution of this taskwas contracted.

Despite initial scepticism, four months later, on March 18 of this year, the first gas carburization experiment was successfully carried out using a satisfactory apparatus. For these outstanding achievements, the state honorary title, "Community of Socialist Labor," was conferred on the socialist work community in gas carburization on 1 May 1960.

Other socialist work communities concern themselves with the solution of tasks like the introduction of advanced working methods into finishing processes, the attainment of production increases in the ten year periods, safeguarding and raising the quality of products, etc.

Through the creation of the socialist research communities, a more rapid fulfillment of research and development tasks, and rapid

conversion of the results into mass production is being achieved. The socialist research community, "Driving-Gear with Equal Revolutions per Minute," with 22 members from the same plant has the task of shortening the production time of driving-gears with equal number of revolutions, which is an urgently needed improvement. Already, by choice of the members of this socialist research community, fellow-workers of the construction, experiment, raw materials laboratory, technology, economics of semi-finished products, sample construction departments, etc., favorable conditions for improvement were created. However, it must once more be pointed out that a small number of the manual workers who will subsequently produce these driving-gears could already at this time submit useful proposals.

Also in the construction of airplanes, socialist work communities comprising several plants are assuming greater importance. Thus, the combined work communities, "Hydraulic Equipment," and "Pressurized Chamber Equipment," are to solve the coordinated task problems between the VEB Industrial Works Karl Marx-Stadt and the VEB Airplane Factory Dresden in order to arrive at a more rapid development of these facilities. The department representatives of both plants work there. Since none of these socialist work communities has received any concrete work directives from either side, and since at this time the plan for research and engineering represents the only basis of their work, the management of both plants would have to support these work communities and give them a working program commonly arrived at.

Socialist Community Work and the Ninth Plenary Session

The Ninth Plenary session of the Central Committee of the Socialist Unity Party of Germany has confirmed the correctness of the resolutions of the Fifth Party Congress of the Socialist Unity Party of Germany, and revealed that a constantly rising number of the working people are basing their work on these resolutions.

The Session assessed the importance of machine construction and metallurgy for carrying out the socialist reconstruction of our economy and established the tasks that are to be fulfilled by the machine constructors and metallurgists. The resolution points out the following:

"While making full use of the advantages offered by our socialist production relations, the most important task is to increase labor productivity to the highest possible degree in our struggle to reach the world standard through the extensive application of the latest scientific knowledge, and, through utilization of all reserves, to reduce the production cost." /The Ninth Session of the Central Committee of the Socialist Unity Party of Germany, published by Dietz, Berlin, 1960, pp.515./ The resolution of the Ninth Plenum is of great importance also for work in the airplane industry, and for this reason it has to be thoroughly evaluated. In the reports and discussions it was conclusively established that socialist reconstruction and socialist community work represent the key to the solution of the complicated tasks of our industry. For this reason, in socialist community work, the reconstruction plan

of the individual plants in airplane industry has to be constantly improved, and deadlines for the solution of the tasks met. Herman Grosse, the deputy chairman of the state planning commission, stated quite accurately at the ninth plenary session that the solution of the decisive problems has to be successful in socialist community work. One of these basic tasks, especially in the construction of airplanes, is a radical improvement in standardization. On this point, Herman Grosse said:

"This means, first of all, to do away with the narrow-mindedness of the offices of standardization, to overcome the department spirit and to make everybody participating in the organization of production do his own share in the solution of standardization problems. A basic rule for standardization is that only socialist community work makes maximum success possible!"

We have learned from these observations that socialist community work is of primary importance in the solution of tasks in airplane industry. The management in airplane industry is facing the task of raising their work production to a higher level in order to improve quantitatively and qualitatively the socialist community work, and to fulfill the tasks that have been set by the party and government.

EAST GERMANY

MOLYBDENUM SULFIDE LUBRICANTS OF THE GERMAN DEMOCRATIC REPUBLIC

[Following is the translation of an article by Chemical Engineer Bunge in Chemie Rundschen (Chemical Review), Vol II, No 49, Leipzig, 9 December 1960, page 5.]

The heavy duty lubricant molybdenum sulfide, on which we reported in No 27 (p. 5), is becoming of ever greater importance to the economy of the German Democratic Republic. It has helped in the solution of many difficult problems of lubrication, and molybdenum sulfide is continuously finding new areas of application. Pure molybdenum sulfide powder (chemical formula MoS_2) suitable for lubrication can be manufactured by means of a complex process from molybdenite found in nature. Through flotation one first derives a molybdenite concentrate with a MoS_2 content of 80-90 percent. The residual foreign components of the ore are isolated by means of various acids, the molybdenum sulfide itself remaining unaffected, thanks to its chemical stability. The natural crystal structure of molybdenum sulfide remains fully preserved in the process. The undesirable, partly abrasive components found in the ore are, however, entirely removed.

The determining factors in the effectiveness of a lubricant are primarily its crystal structure and its degree of purity; in technical application, however, the size of the grain of the MoS_2 particles is also of significance. Most areas of application require the finest grain possible. A very fine grade of molybdenum sulfide powder, for example, facilitates the formation of surface film and contributes to the improvement of the suspension capacity of molybdenum sulfide in such media as fats and oils.

The molybdenum sulfide products of the German Democratic Republic have distinguished themselves all along through their high degree of purity, which surpassed that of foreign MoS_2 products. The manufacturing concern in the German Democratic Republic, the VEB Electro-Chemical Combine Bitterfeld, was aware, however, that the degree of pulverization of its MoS_2 products at the beginning of this year did not meet all demands. Intensive research was required to find possibilities of bringing molybdenum sulfide powder, with its tendency toward lubrication and agglomeration, to the desired degree of pulverization on a technical scale. This assignment is now completed. After numerous experiments a Socialist research team in the Analytic Laboratory of the VEB Electro-Chemical Combine Bitterfeld has succeeded in attaining granules of a maximal size of 5/um (range: 0.1 to 5/um) in the pulverization of molybdenum sulfides: the minute quantity of one thousandth and one ten thousandth of a millimeter.

After the opening of a pulverization plant in the VEB Electro-Chemical Combine Bitterfeld -- constructed according to the highest modern standards -- molybdenum sulfide heavy duty lubricants, superior not only in purity but also in the degree of pulverization to any comparable products of Capitalistic countries, have been available to the economy of our Republic since April of this year.

Nevertheless, development does not stand still. The Socialist research team "Molybdenum Sulfide" of the VEB Electro-Chemical Combine Bitterfeld already has new possibilities in view: to produce in future molybdenum sulfide lubricants designed for special problems and consisting of even finer granules (Maximal size of grain amounting to 0.5/um) in order to continue to have a voice in the setting up of world standards for MoS_2 lubrication products.

EAST GERMANY

PIESTERITZ NITROGEN WORKS COMPLETE ANNUAL PLAN FOR ORGANIC GLASS

[Following is the translation of an unsigned article in Chemie Rundschau (Chemical Review), Vol II, No 49, Leipzig, 9 December 1960, page 2.]

The personnel of the Organic Glass Division of the Piesteritz Nitrogen Works had already fulfilled their annual plan by 29 November. On the basis of the increase in production achieved this year the chemical workers have set themselves the goal of raising production ten percent in the coming year, instead of by the seven percent originally planned. The organic glass is produced in clear or colored plates, is absolutely non-splintering, very lightweight, and can be worked up without splintering, or shaped at warm temperatures. Organic glass is used in various ways in the vehicle industry, in the production of precision instruments and optics, for the manufacture of measuring instruments, and in other branches of industry. The increase in production is the result of the outstanding labors of the total collective. The extensive inclusion of the workers into management has led to the submission of 97 suggestions for improvement; 76 of these have been adopted up to the present, yielding a total profit of 254,000 DM. This corresponds to a profit of 3,000 DM per capita of the personnel. In addition to this the collective has saved on raw and auxiliary materials to the amount of 285,000 DM. If the norms for expenditure of materials were still being overstepped at the beginning of the year, united effort was able to check or undercut them in the following months.

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EAST GERMANY

MORE AND BETTER FODDER

[Following is the translation of an article by Erwin Schneider in Chemie Rundschau (Chemical Review), Vol II, No 49, Leipzig, 9 December 1960, page 2.]

Workers of the sediment works of the VEB Film Factory Wolfen are striving to produce more and better feed for our LPG [abbreviation unexplained in source].

For four and a half years the various institutes of our German Democratic Republic concerned with animal nutrition and feed have been conducting dietary experiments with a powder produced by the Film Factory Wolfen.

In the production of cellulose only 45% of the wood is utilized; the remainder has, until now, been released into the rivers in the form of sulfite leach. Dr. Pietz, the factory manager, believed, quite correctly, that this leach must contain substances whose biological action was valuable for agriculture. Feeding experiments established a significant increase in weight: pigs, to whose diet certain quantities of powder were added, gained on the average 75 kilograms in the course of 154 days, while animals not receiving powder supplements recorded only a weight increase of 55 kilograms. A very valuable observation made at the time was that in using the powder the animal body builds up more meat than fat.

The Socialist workers' association in the sediment works of the Film Factory Wolfen (Dr. Pietz, Dipl. Eng. Meinhardt, Biological technician Schwanz, masters Janiszewski and Wendel) laid the groundwork for achieving a 13 day start on the Plan this year and for enabling us to give an extra 195 tons of albumen-containing feed supplement for the disposal of our agriculture. This simultaneously ensures advance in the 1961 Plan of the sediment works of the Film Factory Wolfen and a two percent increase in the 1961 Plan, a proud balance.

These successes give assurance to the delegates to the Fourth German Peasant Congress that chemistry, too, according to the directives for increase in market production given at the Seventh and Eighth Plenary Sessions of the Central Committee of the SED, is fulfilling its part and contributing to the further strengthening of our Socialist agriculture.

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RUMANIA

ON THE CLASSIFICATION OF AGRICULTURAL TRACTORS

[Following is the translation of an article by Chiriac Vasiliu in Mecanizarea si Electrificarea Agriculturii (Mechanization and Electrification of Agriculture), Vol VI, No 2, Bucharest, 1961, pages 32-35.]

([Note:] With the publication of this article we are opening for review a discussion of the basic index in the classification of tractor systems, to which specialists in the area of agricultural mechanization are requested to contribute. We invite readers and co-workers of our review to send their personal opinions regarding this problem to the editors.)

Within the general plan of machines for the complete agricultural mechanization of their countries, members of CEMA have chosen a sole basic standard in tractor classification: motor power.

In this way twelve classes of tractors have been established (Table 1).

Table 1

Class no.	1	2	3	4	5	6
Horse power	2.5-3	6 + 10%	9 + 10%	16+10%	22+10%	28+10%
Class no.	7	8	9	10	11	12
Horsepower	36+10%	45+10%	60+10%	75	100	150

Within this group of tractors, use has been foreseen of tractor classes 3 (9+10% hp), 6 (28+10% hp), 8 (45+10% hp), and 11 (100 hp).

The structure of this classification, based upon engine power, seems unrealistic since it generally does not fully succeed in characterizing the performance of an agricultural tractor. This plan has also been disputed by the Tractor Research Institute (NATI) of Moscow.

Despite the fact that one single standard, however, well chosen it may be, cannot fully represent the most important functional and construction characteristics of a tractor, well-defined though these may be, the choice of a representative standard is nevertheless a necessity; tractor classifications must be made according to one or, at most, two classification indexes which define the tractor's characteristics and mark out its area of use.

In different countries and at different stages, tractor classification has been according to a single standard, or sometimes two. Some which have been used are: drawbar traction power and engine power, maximum number of gangs that can be pulled, engine power alone, traction power, engine power and traction power, and so forth.

Traction power and engine power. Until 30 to 40 years ago, these two standards were frequently used to indicate tractor class, which was expressed as a fraction. Many tractors were designated with its own fraction: 10/20, 15/30, 22/36, and so forth, the traction power being indicated in the numerator and engine power (driving wheel power) in the denominator.

Traction power (drawbar power) is an index that characterizes the efficiency of a tractor rather well, given the known characteristics of the soil being worked, the crop being harvested, and so forth. It is the result of the power developed at the drawbar and the tractor's displacement speed. This index depends in great measure upon working conditions, and this dependence is not the same for tractors with different types of motors.

This is still another reason that the need was felt for also indicating engine power.

For all this, tractor equipment is even now expressed in both physical and conventional units, the conventional tractor being one with a drawbar power of 15 hp.

However, traction power fails to describe the group of machines that can be used with the tractor, inasmuch as one of the most important factors in this use, drawbar power, cannot be brought out. As such, this basis for tractor classification has been gradually abandoned.

Number of plow gangs. The maximum number of plow gangs that can be used with a tractor is greatly influenced by soil conditions, since soil resistance in plowing presents very large variations (0.3 to 1.2 kgf/cm^2). These variations lead to a rather inconclusive orientation on tractor characteristics, at least when expressed by number of plow gangs.

With a tractor putting out the same drawbar power, between one and four gangs can be drawn, depending on whether the soil has a resistance of 1.2 kgf/cm^2 or 0.3 kgf/cm^2.

Therefore, in practice the number of plow gangs with which a tractor can be combined is indicated by some tractor producers

with a scale, for example, 2-3 or 3-4 gangs.

It is clear that such an indeterminate index cannot be recommended for use as a basic index in tractor classification.

Engine power, or driving wheel power, is taken as the basis of the present classification of tractors. It is very good for characterizing a tractor's use capabilities for stationary jobs, but only to a small extent for work with moving agricultural machinery.

Tractor classification by engine power was adopted and used in the USSR, but has nevertheless had to be given up for several reasons.

In the first place, true tractor use indexes depend greatly not only on engine power but also on the tractor's wheel-drive system. Thus wheel-type and crawler-type tractors with the same engine power, although counted in the same class, have such different use characteristics that their inclusion in the same class creates unacceptable inconveniences.

In the second place, in tractor construction and many other technical areas, a tendency has developed for increasing productivity by the use of greater speeds, a practice which has led to systematic increases in engine power.

Thus in 1953 the MTZ-2 model tractor had an engine power of 37 hp, while in 1960 its power had been raised to 50 hp, despite the fact that, generally speaking, the drawbar traction power and, consequently, the combines powered by it have not changed.

For these reasons engine power cannot be made the basis for tractor classification.

In the last few years some tractor-producing firms have ceased to indicate tractor engine power in technical terms, preferring to indicate the cylinder capacity of the engine, since the motor can often be forced without modifying the cylinder.

Traction power. The possibility of powering soil-working agricultural machinery from a tractor, which depends upon the former's resistance to traction, is determined by the drawbar traction energy measure of the tractor. It is on the basis of this traction power, according to the NATI, that a standard can be indicated for the determination of the tractor's class.

"Since a tractor can operate with different degrees of efficiency within a wide range of traction powers," say the specialists of the NATI, "it is necessary to define which particular traction power is to be taken as a base.

"In the USSR it is customary to give the name nominal traction power to the maximum traction power at which a tractor can operate at a fairly high degree of productivity; this traction power has been chosen as an index of classification.

"Choosing the traction power as the basic tractor measure has the advantage of keeping the tractor classes stable independently of increases in working speed or tractor power.

"The experience of the last few years has shown that increases in working speed require increases in engine power, thus keeping the tractor class unchanged.

"For example, the class of the Belarus basic universal tractor is determined by the fact that it can be coupled to six-row cultivators, three-gang plows, two-row harvesters, and other machines that are part of the accessory machinery belonging to this tractor.

"The power of the Belarus tractor was 37 hp in 1957, the nominal traction power 1,400 kgf (developed at a speed of 5 km/hour), and it fell within class 7 according to classification as a function of power.

"In time the need for an increase in working speed appeared; the tractor power was increased, reaching 50 hp in 1960. The tractor now develops the same traction power, 1,400 kg, at a speed of 6.5 km/hour, and falls into class 8 according to the power-function classification. Looking ahead, the power of this tractor will be increased to 60 hp (nominal speed 7.5 km/hour), and according to the power-function classification it will pass into class 9.

"Thus a tractor with the same traction power (in the given case, 1,400 kg), coupled to the same machinery, made in the same factory, and very little changed in weight or construction (leaving the motor out of consideration), has passed from class 7 to class 9 in a period of eight years.

"An analogous situation has arisen with other tractors. Tractor power, for all its great importance to the tractor, cannot be a fundamental classification index.

"Against the adoption of traction power as the sole basic classification index, the objection is raised that tractor traction power cannot be determined with the same exactness as motor power. This objection is certainly proper, since traction power depends on the soil being worked by the tractor.

"All the same, for purposes of classification the traction power does not need a more exact determination. To determine a tractor's class, it is enough to make an approximation of traction power (for example, to within $\pm$ 12%.)

"For wheel-type tractors the nominal traction power can be determined by calculation. The adherence coefficient φ, of the tires with the soil, correspond from the point of view of energy to the optimum degree of skid (15 to 16%), and likewise the coefficient f, of resistance to the rolling of a wheel-type tractor on stubble, vary within narrow limits, namely

$$\varphi = 0.55, \quad f = 0.09$$

"The nominal traction power can be calculated according to these formulas:

for tractors with two driving wheels:

$$P = G \frac{(L-a)\varphi - f \cdot L}{L - \varphi \cdot h_{cr}};$$

for tractors with four driving wheels;

$$P = G(\varphi - f),$$

where:

(G) is the working weight of the tractor, corresponding to total utilization of the (calculated) load capacity of the tires;

(L) is the tractor base;

(a) is the horizontal distance from the center of gravity of the tractor to the driving wheel axle;

(h_{cr}) is the elevation of the point of application of resistance to traction above the level of the ground.

"The increase of tractor speeds is a progressive tendency and leads to increased productivity. Nevertheless, this tendency is connected with the systematic increase of power in tractors belonging to the same traction classes. From this fact it follows that in the interests of stability the necessity should be recognized of revising the present system of tractor classification, establishing not engine power but nominal traction power as the basic index of classification." ([Note:] B. I. Gostev and B. V. Sishkin, Candidates in Technical Sciences: "On Basic Indexes in the Classification of Tractor Systems" (NATI document).)

On the basis of the facts shown above, in the Soviet Union (at the suggestion of NATI) classification of tractors by traction power has been introduced; that is, classification by traction power developed by the tractor at the lowest working speed while passing over stubble with normal humidity. A total of twelve traction classes have been proposed, of which nine will be realized by 1965.

The classification adopted in the USSR provides for a systematic increase in tractor power (Table 2).

Table 2

Class Number	Nominal traction power	Engine horsepower		
		1958-1959	Period to 1965	Period to 1980 (tentative)
1	0.2	--	--	6 to 10
2	0.6	14	20 to 24	30 to 42
3	0.9	24	35 to 40	50 to 60
4	1.4	37	50 to 60	70 to 85
5	2	37	50	70
6	3	54	75	105
7	4	--	100	140
8	6	92	175	200
9	9	140	240	300
10	15	--	300	500
11	25	--	--	850
12	40	--	--	1500

The indices given in Table 2 for the period to 1965 have been approved, thus becoming the official criteria for the classification of agricultural tractors in the USSR.

Traction power is a basic measure for the determination of the capability of tractor-powered operation of the majority of agricultural machines, more specially those using power developed from tractor-type engines. For these reasons this measure must be taken into consideration in classifying tractors and self-propelled chasses.

In our opinion, the use of this index alone cannot satisfy the conditions required in choosing tractors for certain agricultural tasks, nor can it express the most important jobs which can be executed with any one tractor chosen by traction class.

Because the maximum energy developed by a tractor at the drawbar is limited by the friction of the tractor against the soil, which in its turn is a function of thrust on the driving shaft of the tractor, the result is that (in principle and for a given tractor weight and build) the depth and width of the draft, for jobs depending on drawbar power, is limited; it still remains possible to increase productivity by means of higher combine speeds, and consequently to get the work done in a shorter time.

Yet, increasing the speed of combines (within bounds permitted by agricultural technology) requires increased tractor engine power.

Thus, if a tractor developing around 1,200 kgf at the drawbar and capable of drawing a three-gang plow at 25 cm depth and 90 cm width in medium soil (0.5 kgf/cm^2) plows at different speeds, it will need engines of powers corresponding to increased working speeds approximately as shown in Table 3.

Table 3

Speed (km/hour)	4	4.5	6.5	7.5	8.5
Power (hp)	37	41	59.6	68.6	77.8

Therefore, tractors that might fall into traction class 4, as proposed by NATI,

$$(1{,}400 - \frac{12 \times 1{,}400}{100} = 1{,}232 \text{ kgf})$$

may be equipped with engines of different powers, in practice leading to results that are likewise different from the point of view of combine productivity. (It is true that engine and possibly gear-box weight might -- though only in small amounts -- affect the weight of the driveshaft and so might influence the traction power.)

There also are jobs in which tractor engine power is mainly used for driving a combine by means of a power take-off. Thus in harvesting cereals with a C-1 type combine, a traction force of around 600 kgf is necessary; at a working speed of 4 km/hour, this represents an engine power requirement of around 15 hp while to drive the combine requires around 25 hp; withholding about 15% reserve, the result is that a 40 to 45 hp engine is capable of driving such a combine under good conditions.

The result of this is that the MTZ-2 tractor, which develops a drawbar power of around 1,200 kg, having an engine power of 37 hp, will be unable to fulfill the working requirements of a stalk-cereal harvesting combine made up of the C-1 drawn harvester, despite the fact that according to its traction class it has adequate drawbar power.

These two examples may be considered sufficient to open a discussion within the framework of our review on the basic index in the tractor system classification.

Our proposal is for this index to be made up of two measures: drawbar power and engine power. The notation should be in the shape of a fraction, the numerator expressing traction power in tons, and the denominator, engine power in hp.

Thus, the MTZ-2 tractor would be indicated by the fraction 1.2/37, while the UTOS-26 tractor would appear as 1.2/45.

An agricultural tractor is, we think, well defined by this classification index, for in it the most important qualities which are, in principle, necessary for a tractor's use are characterized.

- END -